

Corbicula Quilonica, B.

Testa inæquilaterali, trigono-rhomboidæ, gibba, tenui, concentricè subremote costata, costis postice evanescentibus, sulcis intermediis latioribus, sub lente decussatim striatis, albida vel lutea, radiis fuscis angustis ornata; umbonibus prominentibus, apice fere eroso; latere antico breviorè, valde arcuato, angustiorè, postico striato, latiorè; superne et basin versus angulata; margine ventrali medioeriter arcuato; ligamento oblongo intra nates attenuato; pagina interna valde concava, albida, maculis radiisque purpureis ornata; dente mediana valvæ dextræ duplici, dentibus lateralibus brevibus serrulatis.

Lat. 10, long. 8, crass. $5\frac{1}{2}$ mill.

Habitat prope Quilon in stagno cum *Clea Annesleyi*.

The younger shells are more gibbous towards the umbones in proportion to their length than the larger specimens. A tawny-yellow epidermis covers the fresher specimens. The rays are numerous, more or less broad, sometimes appearing as mere lines of small spots, and occasionally spreading so as to make the surface appear nearly black. The species is very distinct from any of the *Corbicula* collected by myself or obtained from Northern or Central India. The shortness of the lateral teeth, on the anterior side especially, is a notable character, as well as the inæquilateral form, which is more conspicuous in the young than in the adult shell.

Dursley, August 29, 1860.

Note.—The water contained in the tank which is inhabited by *Clea Annesleyi* and *Corbicula Quilonica* is probably brackish. A parcel, received while this paper was passing through the press, includes specimens of a *Cerithium* resembling *C. eximium*, Sow., obtained from the same pond, which has a muddy bottom and grassy banks perforated by a small crab. In a large specimen of *Clea*, 10 mill. in length by $5\frac{1}{2}$ in breadth, with five whorls and a less eroded apex, the last whorl scarcely attains $\frac{4}{7}$ of the total length of the shell.

September 3, 1860.

XXXIV.—On the Genera *Peltogaster* and *Liriope* of Rathke.

By W. LILLJEBORG.

[With a Plate.]

[Continued from p. 173.]

Liriope pygmæa, Rathke.

Beiträge zur Fauna Norwegens, Nova Acta Acad. Leop. 1843, vol. xx. p. 60, tab. 1. figs. 8–12. Sine dubio mas junior, tamen non ineunte ætate.

On the 23rd of July, 1858, the author found in the sea, near

the town of Molde in Norway, at a depth of from 5 to 6 metres, amongst other *Paguri*, a rather small specimen of *P. pubescens*, which had a *Peltogaster* on its abdomen. This *Peltogaster* (Pl. IV. fig. 1) appeared to be double, or composed of two. As only one of these (*a*), which was of a reddish colour, contained ova and young, the author supposed at first that it was a bag of eggs attached to the body. But, as there was only a single bag of eggs, it departed from the *Suctorina*, in which there are usually two, although at the first glance *Peltogaster* appeared to approach that group in its structure. The doubt thus raised, as to whether the relation between the two parts was that of a maternal animal and an egg-sac, was confirmed by the supposed egg-sac exhibiting strong contractions, although no similar movements were observed in the supposed body of the *Peltogaster*. These contractions continued until the fourth day, and even after the *Peltogaster* had been dissected and the abdomen of the *Pagurus* had become putrid. On examining the young contained in the supposed matrix (fig. 4), Prof. Lilljeborg found that they were quite different from those of *Peltogaster*; and a further examination of the sac showed it to be a distinct animal, parasitic on the *Peltogaster*. The structure of the young proved them to be Isopoda; and as it accorded perfectly with that of Rathke's *Liriope pygmæa*, the relation between that animal and the *Peltogaster Paguri* is easily understood. *Liriope* is therefore an Isopod which lives parasitically upon *Peltogaster*, and probably also upon other Crustacea. Cavolini's observations prove that this, or a nearly allied form, is sometimes found attached within the body of certain Brachyurous Crustacea; and Dana has several times found in a Balanide a parasitic Crustacean (the *Cryptothir*) belonging to the same family as *Liriope*. These two animals may probably belong to a single genus.

The following is an abstract of Prof. Lilljeborg's detailed Latin description of the mature female filled with ova and newly-hatched young (Pl. IV. figs. 2 & 3):—

Length from the mouth (*2 a*) to the opposite part of the body, where the anus appears to be, 4 millim.; breadth (from *c* to *d*) 7 mill.; thickness 3 mill. The body is composed of two distinct parts. *The anterior part (cephalothorax)* forms the organ of adhesion*; it is convex and smooth above, concave beneath, and exhibits above four distinct segments, of which the two middle ones are larger than the others. These segments are sinuated in the middle in front, and deflected and reflected towards the sides. There is no indication of eyes or antennæ. Beneath, between the first and second segments, is a brown transverse

* This part is deeply fixed in the integument of the *Peltogaster*, even perforating its inner lining membrane.

spot, no doubt indicating the mouth. Towards the base this part of the body becomes much narrower, forming a neck. No external buccal organs are visible.

The posterior part of the body forms merely a matrix or ovisac. It is a reniform sac, convex above and below, with no impressions, folds, or sutures above, but furnished beneath with a longitudinal fissure (fig. 3) or aperture, through which the young escape. This part is of a reddish or flesh-colour, from the red ova and young shining through the transparent skin. At the point where the anus appears to be, there are some brown spots. During the contraction of the animal, some transverse folds appeared on the upper surface (fig. 1 a); these persisted when the animal was preserved in spirit, and perhaps indicate segments. At the posterior extremity of the fissure of the matrix is a round aperture; no doubt, the anus. The skin of the matrix, although transparent, is firm and rather thick.

Upon the cephalothorax, whilst the animal was still attached to the *Peltogaster*, there was a delicate and transparent pendant membrane, probably a cast skin. On the upper surface behind the neck there are an opaque and thick skin and two areas of fibrous structure. The evolution of the valves, or the integument of the matrix, probably commences from these areas. The retrograde metamorphosis in this animal is greater than in *Bopyrus*; there are no antennæ, buccal laminæ, feet, or branchial laminæ.

The Male. Prof. Lilljeborg did not detect the male upon or in the *Peltogaster* to which the female was attached, or upon the female herself. He thinks it very probable that the *Liriope pygmæa* described and figured by Rathke was a young male. On comparing it with the description and figures of Kröyer, representing a younger male of his *Bopyrus abdominalis**, which is the same as *Phryxus Hippolytes* of Rathke, the resemblance is striking. Kröyer's young male *Bopyrus* was $\frac{1}{2}$ line, and Rathke's *Liriope* scarcely 1 line in length. Thus, judging from their size, the latter was more developed than the former. The form of the body, the antennæ, the legs, and caudal appendages, are very similar. There are some differences in the form of the posterior pair of thoracic feet; but their structure is very characteristic, and conformable to that occurring in *Liriope*; and this furnished the author with one of his best reasons for identifying the young of the animal found by him upon *Peltogaster Paguri* with Rathke's *Liriope*. In *Liriope* Rathke found six pairs of abdominal feet, Kröyer only five in the young male of *Bopyrus*; but Rathke has only four in his figure of *Liriope*, and the author found only five in the young of his species. According to

* Naturhistorisk Tidskrift, Bd. 3. p. 291, tab. 1. figs. 21-24, tab. 2. figs. 1-3; Voyage en Scandinavie, pl. 29. fig. 1 t-u.

Rathke and Kröyer, the abdominal feet are biramose in *Liriope*, and simple in the young of *Bopyrus*; but the author has found them biramose in the latter, although the inner branch is the smallest*. Thus a part of these apparent diversities may be ascribed to errors of observation †; and, besides, it is natural that there should be some differences between two different genera. It would appear, also, that Dana supposed Rathke's *Liriope* to be a male because, without further evidence than its resemblance to that animal, he regards his *Cryptothir* as a male. That Rathke found his *Liriope* in *Peltogaster* without the developed female being there also, does not weaken this assumption, as, according to Kröyer, we meet with an equivalent fact in his *Bopyrus abdominalis* (*Phryxus Hippolytes*, Rathke). Kröyer states ‡ that he once found on a *Hippolyte*, which had no female *Bopyrus* under its abdomen, a male which adhered to one of its eyes. Kröyer also asserts that the young females of *Bopyrus* are always found upon young *Hippolytæ*; and in conformity with this, the young females of *Liriope* ought to occur upon young individuals of *Peltogaster*. There is another circumstance which is greatly in favour of the idea that Rathke's *Liriope* was a male. As the female of *Liriope* is subject to a greater amount of transformation than Rathke's *Phryxus* or Kröyer's *Bopyrus*, and as its newly-hatched young are much smaller than those of the latter, but still, notwithstanding their small size, are equally highly developed, it can hardly be believed that the female young, measuring even a line in length, would not be attached and in course of transformation, when a young female of *Bopyrus*, $1\frac{3}{10}$ line in length, has little resemblance to a larva, excepting in its eyes and thoracic feet. On the other hand, the males of this family retain a portion of their larval characters not only longer than the females, but even throughout their lives, or, in other words, retain the characteristic form of Isopods, which is lost completely in the females by retrograde development.

The author gives the following description of the young animal just hatched in the matrix (Pl. IV. figs. 4 & 5):—

Its length is scarcely $\frac{1}{4}$ millim.; its form is that of an Isopod. The body convex above, concave beneath; when seen from above, oval or oblong-oval, rounded in front, and attenuated behind. Segments 14; the first (head) larger than the rest; the last

* In the 'Voyage en Scandinavie,' Kröyer has figured the abdominal feet of the young *Bopyrus abdominalis* as biramose.

† If Rathke's *Liriope* had six pairs of abdominal feet, exclusive of the caudal appendages, it would possess, in all, seven pairs of abdominal feet, which no Isopod can have. Rathke's assertion, that *Liriope* has only six abdominal segments, also appears to contradict his statement.

‡ *Op. cit.* p. 102.

very small, forming a sort of minute plate concealing the base of the last pair of feet. Head a little broader than the following segment; penultimate segment longer than the preceding one, coarctate and rounded behind. Beneath the lateral margins of the thoracic segments there are small acuminate appendages, bent backwards, which are, no doubt, epimera.

Eyes usually none; sometimes a reddish-brown one on each side (fig. 5): when no eyes are present, there are usually two cells, with reddish-brown pigment, in their place. Similar pigment is seen in several parts of the body, especially behind.

Antennæ of the first pair (fig. 4 *a*) very small, quadriarticulate, having about five setæ, of which two are apical. Antennæ of the second pair (fig. 4 *b*) large, half as long as the body without the apical setæ, quinquearticulate, with the third joint longer than the rest, and the last joint having three or four apical setæ, of which one is very long. Region of the mouth produced; oral aperture forming a transverse fissure. On each side of the mouth there is a mandibuliform appendage.

Thoracic feet (fig. 4 *c*) six pairs, attached to the six thoracic segments; all, except the sixth pair, similar, but the posterior pairs a little longer than the anterior. The five anterior pairs somewhat cheliform, with a rather large, nearly oval palm, bidentulate within, and a curved, acute, apical claw. Sixth pair of feet longer and more slender, and not cheliform (fig. 4 *d*); palm long and attenuated; claw long, nearly straight, and not retractile.

Abdominal feet five pairs, attached to the five anterior segments of the abdomen, all similar, except that the posterior are a little shorter; they are biramose, with the scape two-jointed, and the branches nearly equal, the outer furnished with three, and the inner with two, long, apical, ciliated setæ (fig. 4 *e*). The last pair, or caudal feet (fig. 4 *f*), are larger and stouter, furnished with several large and strong ciliated setæ, and also biramose. The scape of these is of one thick joint, obliquely excised at the apex, and furnished beneath with one or two slender setæ. The outer branch is a little thicker and shorter than the inner one, and has three stout, curved, apical setæ; the inner one is obliquely excised at the apex, and furnished with two slender setæ. At the base of the inner branch a long and nearly straight seta is attached to the scape.

No intestine could be clearly seen, but in its place there was a patch of a brownish and reddish colour, especially behind; and here and there in the body were larger and smaller oily vesicles, no doubt the residue of the yolk.

On comparing this young animal with the *Liriope pygmæa* of Rathke, their relation is so close, that the differences, from the

analogy of *Bopyrus abdominalis*, Kröyer, may readily be ascribed to difference of age, and perhaps of sex. The young animal described by the author was only one-twelfth the size of that described by Rathke. The latter is more elongated, and has one more pair of thoracic feet; the first pair of antennæ are furnished with several setæ; most of the thoracic feet are apparently shorter; the abdominal feet are a little shorter; and the caudal feet are differently constructed, being simple, while the young observed by the author have them biramose. But these and some other differences occur also between the young male of *Bopyrus abdominalis* figured by Kröyer and the still younger larvæ of the same species. Hence the author does not hesitate to consider the parasitic Isopod found by him upon *Peltogaster Paguri* as belonging to the same species as *Liriope pygmæa*.

Now, as it lives parasitically upon *Peltogaster Paguri*, its presence in the cavity of the latter, where it was found by Rathke, is explained without much difficulty. The *Peltogaster* may have borne a fully developed female *Liriope*, which, after reproduction, had fallen off, whilst some of the young may have remained behind upon the *Peltogaster*, and walked about until, finding the orifice at the anterior extremity of the body, they entered by it; or they may have been in search of young females upon the *Peltogaster*, and remained attached to the latter, just as Kröyer found a male of *Bopyrus* attached to the eye of a *Hippolyte* on which there was no female. The author is in favour of the latter opinion, as he thinks that if a mature female of *Liriope* had detached itself from the *Peltogaster*, the marks of its adhesion could not have escaped Rathke's observation.

With regard to the systematic position of *Liriope*, Rathke was evidently wrong in considering it as an Amphipod; and indeed he indicates its "resemblance to some Isopoda of the genus *Idothea*." Dana was the first to recognize its Isopod nature; he places it in the family *Tanaidæ*. Steenstrup asserts it to be an Isopod of the family *Bopyridæ*; and his view of the relationship of *Liriope*, and its connexion with *Peltogaster*, is accurate. It is with the *Bopyridæ* that Prof. Lilljeborg arranges this singular genus, of which he gives the following character:—

Genus LIRIOPE, H. Rathke.

Animal e Crustaceorum classe, Isopodorum ordine, et Bopyridarum familia.

Fœmina adulta corpore in partes duas distinctas diviso; anterior sive cephalothorax, caput et tria segmenta sequentia comprehendens, est cum posteriore indivisa parte majore, sive matrice, quasi

per collum connexa. Nulli oculi, nulli pedes, nullæque appendices branchiales. Pullus et sine dubio mas iisdem *Bopyri* admodum similes, et fere tantummodo pedibus thoracicis postremi paris, ungue longo et recto neque retractili armatis, diversi.

EXPLANATION OF PLATE IV.

- Fig. 1.* *a.* *Liriope pygmæa*, female, containing eggs and young, attached to the *Peltogaster Paguri*, *b*, which is fixed in its turn to *Pagurus pubescens*, Kröyer; all seen from above.
- Fig. 2.* *Liriope pygmæa*, female, dead and preserved in spirit, seen from above: *a*, anterior extremity of the body, or cephalothorax; *b*, posterior part of the body, or matrix; *c*, the right, *d*, the left side.
- Fig. 3.* *Liriope pygmæa*, female, alive, seen from beneath: *a*, anterior extremity; *b*, posterior part with the supposed anal aperture, and the fissure of the matrix between this aperture and the anterior part of the body (cephalothorax). On the cephalothorax the mouth is seen as a black point.
- Fig. 4.* The larva of *Liriope* seen from above: *aa*, anterior antennæ, or first pair; *bb*, posterior antennæ, or second pair; *cc*, five anterior pairs of thoracic feet; *dd*, sixth or last pair of thoracic feet; *ee*, five anterior pairs of abdominal feet; *ff*, last pair of abdominal feet, or caudal feet.
- Fig. 5.* The same, seen from the left side.
- Fig. 6.* *Pachybdella Carcini*, seen in front (after Lovén): *a*, acetabulum; *b*, orifice of the pallium.
- Fig. 7.* The same, opened: *a*, acetabulum; *b*, orifice of the pallium; *c*, the fleshy body; *dd*, the ramified external ovaries (ovarian cæca).
- Fig. 8.* The organ of adhesion of *Peltogaster Paguri*, seen from beneath: *a*, the orifice of the mouth; *b*, the buckler, to which the acetabulum is attached by its neck beneath the *Peltogaster*. In this buckler concentric striæ of cement are seen; and attached to the margins of the acetabulum are fragments of the epidermis of the *Pagurus* to which the *Peltogaster* was attached.
- Fig. 9.* The two primary ovaries of *P. Paguri* surrounded by a cellular membrane and different formative matters.
- Fig. 10.* *Peltogaster sulcatus*, filled with eggs and deprived of its pallium. The two sacs of eggs are completely united and surrounded by the delicate membrane which clothes the cavity of the body, and which adheres by a cellular tissue to the inner surface of the pallium or skin. This membrane is produced at *b*, over the inner surface of the short tube which surrounds the anterior orifice; *aa*, the two parts supposed to be male generative organs, probably *vesiculæ seminales*.
- Fig. 11.* One of the seminal vesicles magnified.
- Fig. 12.* *Peltogaster Paguri*, filled with eggs, seen from above (length 13 millim.): *a*, acetabulum; *b*, anterior aperture of the body; *c*, posterior extremity of the body, with a fissure and internal line of demarcation between the two sacs of eggs, which is continued towards the anterior extremity.
- Fig. 13.* The same, deprived of the organ of adhesion, seen from beneath (length 9 millim.): *a*, the anterior orifice of the body; *b*, the posterior extremity, with the boundary between the two sacs of eggs.

Fig. 14. *Peltogaster sulcatus*; the animal seen from the left side: *a*, the organ of adhesion; *b*, the anterior orifice of the body.

Fig. 15. *Peltogaster microstoma*; the animal seen from the left side: *a*, the organ of adhesion; *b*, the anterior orifice of the body.

Fig. 16. The larva of *P. microstoma*, at the point of being hatched, seen from above.

Fig. 17. The larva of a *Pachybdella* (after Cavolini).

XXXV.—On the Arrangement of the Land Pulmoniferous Mollusca into Families. By Dr. J. E. GRAY, F.R.S., V.P.Z.S.

THE opportunity of examining the genus *Ancitea*, and the additional information obtained by the publication of the anatomy of it by Dr. Macdonald, and of that of *Janella* by Mr. Knight, has induced me to reconsider the subject of the arrangement of the terrestrial Pulmonata or *Pulmonata geophila*, given in the Catalogue of Pulmonata, or Air-breathing Mollusca, in the British Museum, published in the year 1855.

I would suggest, for the arrangement given at page 2 of that Catalogue, the following:—

1. PULMONATA GEOPHILA. Eyes at the apex of an elongated cylindrical peduncle. Tentacles cylindrical, shorter and lower down than the eye-peduncle, sometimes very small or wanting. Operculum none (except in young *Cryptellæ*?). Terrestrial.

A. Head, eye-peduncle, and tentacles retractile under the skin.

Sect. 1. VERMIVORA. Buccal mass very large, elongate, projectile like a proboscis. Jaw none; teeth numerous, slender, conical, distant. Mantle well defined. Subterraneous; carnivorous, or worm-eating.

* *The spiral part of the body near the middle of the back. Head without any lateral grooves from the front of the mantle to the outer edge of the eye-peduncles.*

1. OLEACINIDÆ. The tentacles cylindrical, simple; the labial tentacles elongate, produced, flat, angularly bent. Shell oblong, spiral; the outer lip thin, sinuous. *Oleacina*.

It is to be observed that some *Helicinidæ* have shells so like *Oleacina* (as, for example, *Achatina folliculus*), that it is impossible to distinguish them from the shells of true *Oleacina*; yet Moquin-Tandon has figured the animal and the jaws of them, showing their Helicine character and phytophagous habit (see t. 20 & 22), and the animal and jaws have been observed in several other species that have been referred to this genus on account of the form of shell. The genus *Halea*, which differs from *Oleacina* only in